

How to Deal with Invasive Species? A Proposal for Europe

PHILIP E. HULME, WOLFGANG NENTWIG, PETR PYŠEK & MONTERRAT VILÀ



For Europe to address biological invasions at a continental scale there must be an end to the fragmented legislative and regulatory requirements addressing invasive species, an end to uncoordinated activities led by the different Directorates General of the European Union that do not appear to appreciate the cross-cutting nature of biological invasions, an end of the piecemeal approaches to tackling invasive species across Europe that fail to coordinate pre- and post-border actions and of course an end of underfunding of taxonomy, management efforts and basic research on invasive species. More than ever before, a single European coordinating centre with a specific remit to manage biological invasions is needed (Hulme et al. 2009a). A new agency, the European Centre for Invasive Species Management (ECISM), should be developed, perhaps along the lines of the European Centre for Disease Prevention and Control (ECDC), with a mission to identify, assess and communicate current and emerging threats to the economy and environment posed by invasive species. ECISM would integrate all invasion related activities across Europe and target six key areas: scientific advice; coordinating surveillance; identification of emerging invasion threats; initiating responses; supporting training; and communicating to the public and stakeholders (Hulme et al. 2009b).

Scientific advice and research direction

The study of biological invasions is still a young research field with rather fragmented knowledge: we do not have sufficient information on those characters which make a species invasive. This makes plausible prognoses extremely difficult, especially since biological invasions often show stochastic characteristics, influenced by a variety of events and driven by different factors. Today, we still have limited information on the spreading capabilities of species, their pathways into invaded habitats, and on the invasibility of ecosystems. Impact data are only available for 10 % of all alien species (Vilà et al. 2010) and this makes prioritisation among several alien species very difficult, if not impossible. Besides research at the species level we need more experimental investigations at the ecosystem level to understand how invasive species alter ecosystem structures and services. Our world is actually changing very fast and we would like to understand the interdependence of invasive species, global climate, land use changes and changes in biogeochemistry caused by changes in economic development and society trends (Nentwig 2007). In this regard, ECISM would establish a reputation for scientific excellence and leadership and be a major resource for scientific information and advice on biological invasions for the Commission, the Parliament, the Member States and their citizens. It would achieve this by:

- Being a catalyst of biological invasions research.
- Promoting, initiating and coordinating scientific studies.
- Producing guidance, risk assessments, scientific advice.

This would involve improving research on biological invasions in the EU. ECISM would identify gaps in scientific knowledge and work with EU funders to steer research calls, as well as evaluate proposals. It would build links between scientists by maintaining an interactive directory of experts and running scientific symposia. The kind of research would cover both ecological understanding as well as technical solutions. This includes technologies to prevent invasive organisms from being transported via containers or by other introduction vectors, in or on other organisms, in wood or soil etc. Once an invasive organism has established, any countermeasure is much more costly than prevention, thus, control costs represent a good investment, able to prevent enormous ecological and economic damage. Also the methods which are presently applied may demand further improvements in efficacy, ease of application and costs. Of special concern is waterborne transport: its economic importance will continue to increase and the number of alien species spread by ships is expected to rise concurrently. For aquatic organisms, the most prominent invasion vectors are ballast water and hull fouling of ships, important pathways include the waterway networks in Europe or maritime canals, and technical solutions to minimise the spread of aliens are urgently needed.

Surveillance and early warning

An early warning system and the surveillance of key entry areas, based on warning lists of most dangerous alien species, and immediate removal of newly detect-

ed invaders is the best strategy for management. This implies that expertise for the identification of relevant taxa is available, the responsible authorities established contingency plans for the eradication of specific taxa, and suitable methods are on-hand. Eradication of an alien species is always better than its control or management because the latter implies the persistence of the alien, and cannot prevent future ecological and economic impacts. ECISM would be responsible for the surveillance of invasive alien species in the EU and maintain the databases for such surveillance. It would:

- Develop integrated data collection systems covering all member states, maintain the databases for surveillance and establish EU-wide standard case reporting.
- Coordinate and ensure the integrated operation of the dedicated surveillance networks and support strengthening of national surveillance systems.
- Monitor trends of invasive species across Europe in order to provide a rationale for actions in member states and disseminate the results to stakeholders for timely actions at EU and country levels.

This system will facilitate access to and exchange of information concerning invasive species, including, data on distribution and abundance of invasive species; their life histories and the economic, environmental, and human health impacts they might cause. A relevant step towards a comprehensive database of alien and invasive species in Europe and of experts has been achieved within the DAISIE project (www.europe-aliens.org, DAISIE 2009). Now, this database needs further maintenance and development to an early warning system.

Horizon scanning and risk assessment

Major challenges for the development of an integrated invasive species risk assessment scheme in the EU include the absence of data required to make accurate analyses of the risks throughout the region, risk assessment processes have insufficiently exploited important new scientific and technological developments, and the risk assessment procedures are complex, discouraging take-up among all EU member states (Baker et al. 2009). Many factors need to be considered to determine whether particular pathways can introduce pests; a particular pest can enter, establish and cause impacts in an area; and what measures would be appropriate to reduce the risk to an acceptable level. In cooperation with the member states, ECISM will establish procedures for systematically collecting, collating and analysing data across the globe with a view to identify emerging invasion threats which could affect the economy, environment and health of the Community. Activities would include:

- Preventing the intentional introduction and spread of invasive species, including the identification of emerging pathways.
- Minimise the risk of introductions via unintentional pathways.
- Provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species.

ECISM would forward to the European Parliament, the Council and the Commission an annual evaluation of the current and emerging threats from invasive species in the Community. ECISM will assess the potential economic and environmental impacts, capture and communicate uncertainty, map future endangered areas, summarise risk, link pathway analysis to the construction of systems approaches to prevent pest entry and create a decision support system for the management of pest outbreaks.

Rapid and continuing response

Much more effort has to be made to eradicate invasive species. Experience shows that it is possible to successfully eradicate alien species if careful planning, sufficient financial support and adequate political and social assistance are provided. In contrast, there are numerous cases of invasive species which were not removed because of limited awareness by decision makers, gaps in the legal framework or authorisation process, ignorance, or due to public opposition. ECISM would be

the EU reference point to support the investigation and control of continuing and emerging invasion problems, including the:

- Appropriate and timely reaction in case of invasion threats.
- Coordinated approach in outbreak investigation and control between affected countries.
- Rapid mobilization of European experts in response to requests for assistance from countries.
- Efficient communication between all stakeholders during response activities.

ECISM would aim to ensure the rapid mobilization of “outbreak assistance” teams, diagnostic capacity, and the immediate availability of the necessary material for priority eradications. For longer term management, guidelines and standard operating procedures would ensure that biological invasions are managed in an effective and coordinated manner.

Training and capacity building

Maintaining a relatively low exposure to pests and diseases is essential to the economic viability and environmental health in Europe. To maintain this level we must ensure the effective exclusion, eradication and management of invasive species. These goals can only be achieved if a sufficient number of people equipped with appropriate knowledge and skills in the management of invasive species are available in Europe. Presently, the education opportunities in Europe are limited to a small number of courses that build on generic provision in agricultural or environmental sciences, with minor specialisation in specific areas of invasions. While suitable for undergraduate training, these courses do not deliver the targeted training required by professionals working in this area. Therefore, current educational opportunities on offer in Europe may not adequately address current industry needs. The development of capacities in the EU to respond to biological invasion threats depends on the availability of training resources. ECISM would support and coordinate training programmes in order that the member states and the Commission have sufficient numbers of trained specialists, particularly in species identification, surveillance techniques, risk assessment, species distribution modelling, forecasting and population dynamics, and management techniques. Activities would include:

- Assessment of training provision across Europe relevant to management of invasions.
- Provision of short-courses targeted at professional development in key skill areas.
- The development of a network of training partners and sharing of training materials.
- Coordination and recognition of professional qualifications in invasive species management.

ECISM would develop training curricula, promote use of a common language among European invasive species researchers, and produce field manuals for the management of alien species.

Public awareness and stakeholder consultation

Our society usually is not aware of its dependence on nature and neglects the threat of biological invasions, thus specific education programmes or public

awareness campaigns are necessary. This education from school level onwards should cover the whole society but especially specific sectors such as landowners, hunters, fishermen, foresters, gardeners, landscape architects, scientists, people involved in aquaculture and pet trade, and non-governmental organisations, especially animal rights organisations, are major target groups. ECISM would ensure that the public and any interested parties are rapidly given objective, reliable and easily accessible information with regard to the results of its work, act in close collaboration with the member states and the Commission to promote the necessary coherence in the risk communication process on invasion threats as well as with regard to public information campaigns.

- Efficiently communicate the scientific/technical output of the ECISM to professional audiences.
- Communicating key invasion messages to the media and to the European public.
- Support the development of member states communication capacities.

A key activity would be the hosting of an open access e-journal with short rapid communications and longer surveillance and research articles on invasive species including recent records, spatio-temporal trends, inventories and management methods. Public awareness has to be sharpened for two important principles. (1) The precautionary principle implies that future unwanted species introductions should be avoided wherever possible and aliens should be eradicated as soon as they are detected; (2) The polluter-pays principle applies economic costs of the damage caused by an alien species to be refunded by the responsible party. In contrast to the widespread laissez-faire policy, this visualises the connection between alien species and damage to ecosystem structure and function, goods and services, and their market valuation. Market-based instruments have to address invasion externalities and should offer incentives to avoid risks, e.g. licence fees (more risky products would be more expensive), insurance bonds or other cost-sharing instruments. Many exotic birds and fish, released or escaped from captivity into the wild where they cause problems, may serve as an example.

These activities parallel those of ECDC and this agency currently runs on an annual budget of less than € 30 million. In the case of biological invasion, such a sum is less than 0.5 % of the annual cost of alien impacts to the European economy. The benefits gained by coordinated action across Europe will far outweigh these running costs.



References

- BAKER R, BATTISTI A, BREMMER J, KENIS M, MUMFORD J, PETTER F, SCHRADER G, BACHER S, DE BARRO P, HULME PE, KARADJOVA O, OUDE LANSINK A, PRUVOST O, PYŠEK P, ROQUES A, BARANCHIKOV Y, SUN J-H (2009) PRATIQUE: A research project to enhance pest risk analysis techniques in the European Union. *EPPO Bulletin* 39: 87-93.
- DAISIE (2009) Handbook of Alien Species in Europe. Springer, Dordrecht.
- HULME PE, PYŠEK P, NENTWIG W, VILÀ M (2009a) Will threat of biological invasions unite the European Union? *Science* 324: 40-41.
- HULME PE, NENTWIG W, PYŠEK P, VILÀ M (2009b) Common market, shared problems: time for a coordinated response to biological invasions in Europe? *Neobiota* 8: 3-19.
- NENTWIG W (2007) Biological invasions. Springer, Berlin.
- VILÀ M, BASNOU C, PYŠEK P, JOSEFSSON M, GENOVESI P, GOLLASCH S, NENTWIG W, OLENIN S, ROQUES A, ROY D, HULME PE, DAISIE PARTNERS (2010) How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. *Frontiers in Ecology and the Environment* 8: 135-144.